levels and curbing land subsidence. A combination of factors including imported water, natural recharge, decreased pumping and increased artificial recharge has reduced land subsidence to an average 0.01 feet per year.

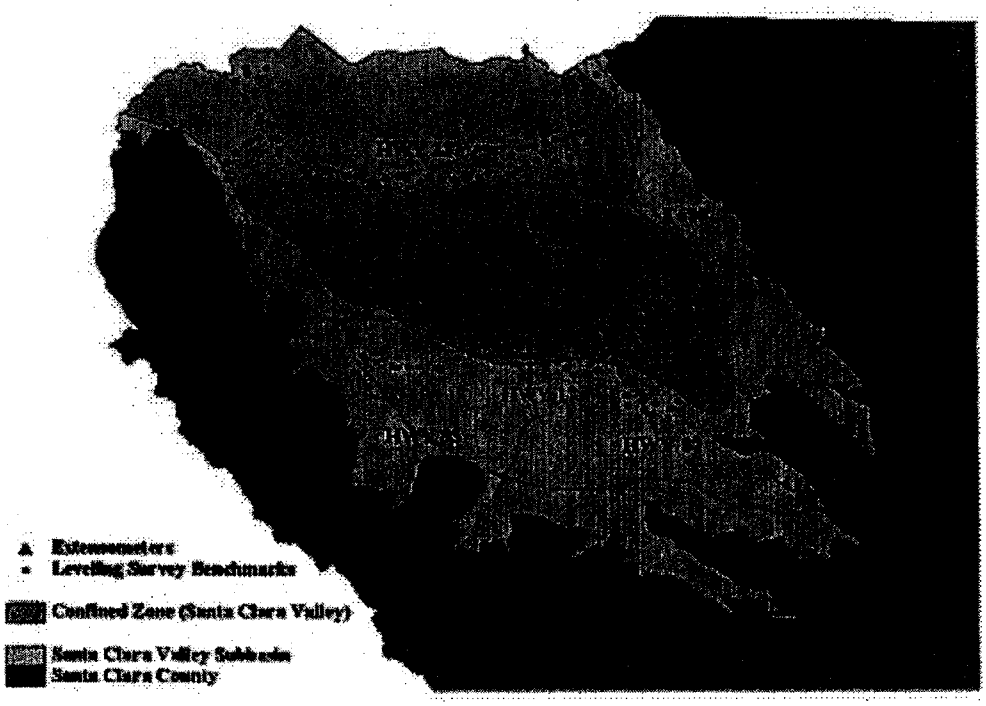
The District developed subsidence thresholds that relate the expected rate of land subsidence from various groundwater elevations. The Predictions Relating Effective Stress and Subsidence (PRESS) computer code was utilized for this model, and 10 index wells located throughout the Santa Clara Valley Subbasin were used as control points for the subsidence calibration and prediction.

Current Status

The existing land subsidence monitoring program includes the following:

- Monitoring land subsidence at two extensometer sites in San Jose and Sunnyvale (Figure 4-3).
- Conducting an annual leveling survey across three different directions in the valley to measure any land subsidence that may be occurring away from the extensometers (Figure 4-3).
- Analyzing data to evaluate the potential of re-initiating land subsidence.

Figure 4-3
Location of Extensometers and Leveling Survey Benchmarks



The extensometer in the San Jose site has recently been upgraded and equipped with monitoring and storage instrumentation to execute the data acquisition process electronically. Data collected from this site continues to be analyzed to determine any changes in the rate of land subsidence.

In 1998, the District entered into a cooperative agreement with the USGS to use Interferometric Synthetic Aperture Radar (InSAR) technology to measure any subsidence that may have not been captured in the existing monitoring program. This new technology compares satellite images taken at different times and reveals any changes in ground surface elevations with an accuracy of a few millimeters. INSAR covers the entire County, unlike traditional monitoring which is site-specific. Under the cooperative agreement, InSAR images were analyzed both seasonally and over a five-year period. Data from this study reasonably replicated and supported the data obtained from the District's extensometers.

The leveling survey continues to be conducted annually. A new leveling line was added to the leveling survey in 1998 as InSAR images indicated that additional information was needed along the Silver Creek Fault in San Jose.

Future Direction

Monitoring and data storage equipment have been installed at the San Jose extensometer site. Plans to enhance the land subsidence monitoring network program include the installation of new equipment to facilitate the monitoring and storage of data from the extensometer site in Sunnyvale, and the evaluation of datum stability at this site.

Through the 1998 study with the USGS, InSAR technology was proven able to reasonably replicate historical subsidence data from extensometers and the cross-valley leveling surveys. District staff will investigate the benefits of incorporating InSAR technology into the current land subsidence monitoring program.

The District will continue to utilize groundwater flow and subsidence models to simulate land subsidence as a result of different groundwater scenarios and groundwater management alternatives.

Chapter 5
GROUNDWATER QUALITY MANAGEMENT PROGRAMS

This chapter describes District programs that address nitrate management, saltwater intrusion, well construction and destruction, wellhead protection, leaking underground storage tanks, toxic cleanup, land use and land development review, and other groundwater protection issues. These programs help protect groundwater quality by identifying existing and potential groundwater quality problems, assessing the extent and severity of such problems, and preventing and mitigating groundwater contamination.

NITRATE MANAGEMENT

Program Objective

The objective of the Nitrate Management Program is to delineate, track and manage nitrate contamination in the groundwater basin in order to ensure the basin's viability as a long-term potable water supply. More specifically, the objectives are as follows:

- Reduce the public's exposure to high nitrate concentrations.
- Reduce further loading of nitrate.
- Monitor the occurrence of nitrate.

Background

The conversion of nitrogen to nitrate is a natural progression in the nitrogen cycle. In the form of nitrate, nitrogen is highly soluble and mobile. Due to its solubility and mobility, nitrate is one of the most widespread contaminants in groundwater. Unlike other compounds, nitrate is not filtered out by soil particles. It travels readily with rain and irrigation water into surface and groundwater supplies.

The amount of nitrate reaching the groundwater depends on the amount of water infiltrating the soil, the concentration of nitrate in the infiltrating water and soil, the soil type, the depth to groundwater, plant uptake rates, and other processes. Nitrate concentrations now observed in the groundwater basin might be a result of land use practices from several decades ago.

High concentrations of nitrate in drinking water supplies are a particular concern for infants. Nitrate concentrations above the federal and state maximum contaminant level (MCL) of 45 milligrams per liter (45 mg/L NO_3) have been linked to cases of methemoglobinemia ("Blue Baby Syndrome") in infants less than 6 months of age. In addition, public health agencies, including the California Department of Health Services, are conducting research to determine whether excess nitrate in food and drinking water might also have long term carcinogenic (tendency to cause cancer) or teratogenic (tendency to cause fetal malformations) effects on exposed populations.

Communities in the South County rely solely on groundwater for their drinking water supply. The District created the Nitrate Management Program in October 1991 to manage increasing nitrate concentrations in the Llagas Subbasin.

In June of 1992, an extensive study was initiated to review historical nitrate concentrations, identify potential sources, collect and analyze groundwater samples for nitrate, and develop a set of recommendations for the prevention and control of nitrate loading in South County. The results of the study, completed in February 1996, indicated that nitrate concentrations in the Llagas Subbasin are generally increasing over time and that elevated concentrations still exist throughout the subbasin.

In addition, the study found that there are many sources of nitrate loading in Llagas Subbasin. The major sources of nitrate are fertilizer applications, and animal and human waste generation. The southern portion of Santa Clara County has historically been an agricultural area. Only in recent years has agricultural acreage declined due to residential growth. However, due to the slow movement of surface water to the water table, residual nitrate concentrations in the soil from past practices may continue to contribute to increasing nitrate concentrations in the groundwater for several years or decades to come.

The specific recommendations of the study were the following: increase public education to reduce loading and exposure; blend water to reduce exposure; review and possibly revise the well standards; increase the level of regional wastewater treatment in order to reduce reliance on septic systems; increase point source regulation; conduct recharge feasibility studies; increase monitoring of the groundwater basin; and to consider alternative water supplies, treated surface water, water recycling and enhanced sewage treatment technologies for on-site systems.

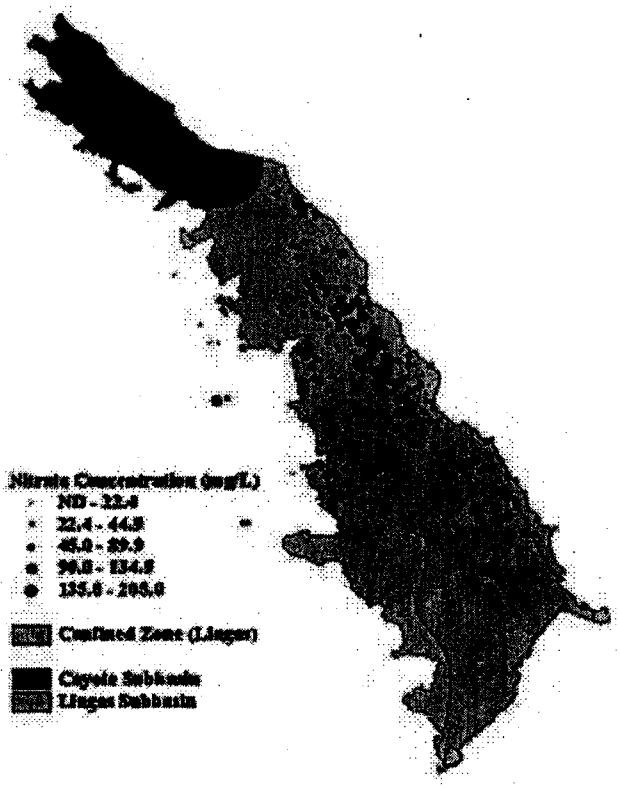
In 1997, the District began implementing the public education portion of the study recommendations. A large agricultural outreach effort was initiated. As part of that outreach, the District entered into a contract with a Mobile Irrigation Lab to offer free irrigation evaluations to farmers in order to improve the efficiency of their irrigation systems and scheduling. By improving the irrigation efficiency and distribution uniformity, the irrigators can reduce the amount of water and nitrate leached beyond the active root zone of the crop and into the groundwater. Over 250 people have attended seminars to increase their awareness of the mobile lab and to learn nitrate-sampling and nitrogen management techniques. Approximately 150 free soil nitrate test kits have been prepared and distributed. A series of 5 fact sheets on Nitrogen and Water Management in Agriculture was produced in cooperation with Monterey County Water Resources Agency and the Pajaro Valley Water Management Agency. English and Spanish versions have been distributed to the agricultural community through a series of seminars, mobile lab operators, other agricultural agencies and the on the District's new Agricultural web page.

To reduce exposure, reduce loading and monitor occurrence, a large-scale public outreach effort was launched offering a free nitrate analysis to all well water users in the Llagas and Coyote Subbasins. Approximately 2,500 residents were notified through

direct mailings about the program and the issues surrounding nitrate in drinking water. An unknown number were notified through newspaper, radio and television coverage. More than 600 private wells shown in Figure 5-1 have been tested for nitrate. Along with the results of the testing, residents were mailed a fact sheet describing what nitrate is, where it comes from, what the health effects are, how to prevent further loading and where to find more information.

Of the 600 private wells tested, more than half exceed the federal safe drinking water standard for nitrate. Of those that exceed the standard, half of the residents use an alternate water source or point-of-use treatment for their drinking water. The data also indicated that nitrate concentrations in the Llagas Subbasin continue to increase, that nitrate concentrations in the Coyote Subbasin have remained steady, and that high concentrations of nitrate are sporadically located throughout both subbasins. A report on the findings was produced in December 1998 and was distributed to several local and state agencies. These elevated nitrate levels were detected only in private wells; it should be noted again that public water supply wells within the County meet drinking water standards.

Figure 5-1
South County Nitrate Concentration

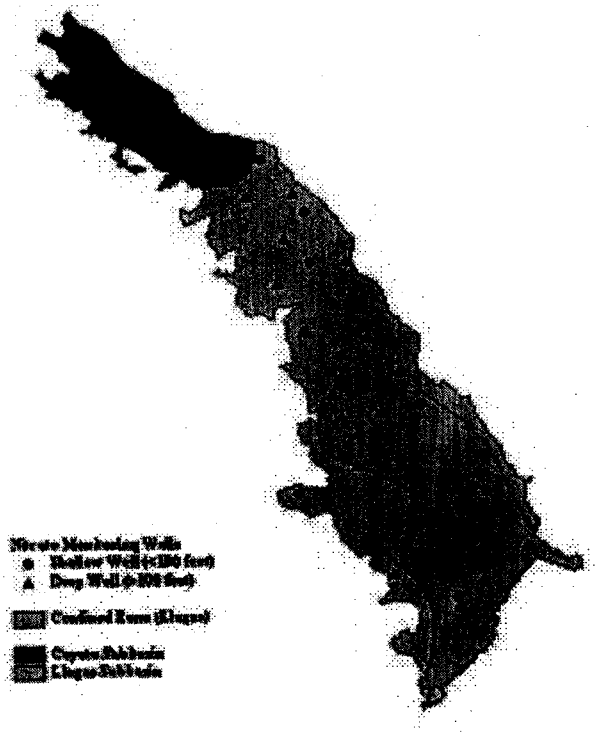


Current Status

To reduce nitrate loading, the District continues to schedule mobile lab evaluations and agricultural seminars. These seminars focus on how to apply irrigation water more efficiently and how to conduct soil testing for nitrate. In addition, the District is a cooperator on a grant with a soil scientist to establish field trials demonstrating and evaluating the effectiveness of in-field nitrate testing in drip and sprinkler irrigated vegetables.

To monitor nitrate occurrence, the District is conducting a comprehensive monitoring effort to track seasonal, areal, vertical and long-term trends in nitrate concentrations. The current monitoring program shown in Figure 5-2 consists of 42 deep groundwater wells (greater than 100 feet deep) and 15 shallow monitoring wells (less than 100 feet deep).The shallow monitoring wells will allow us to track what we might expect to see in the deeper wells in the future. Network wells are being monitored on a quarterly basis to track seasonal variations.

Figure 5-2
Current South County Nitrate Monitoring Network



To reduce nitrate exposure, the District is working with the Santa Clara County Department of Environmental Health to produce a well owner's guide. Among other things, the guide will contain information on recommended sampling, testing and disinfecting practices, as well as measures to protect against contamination.

Future Direction
Continued public education and outreach will remain the focus of the nitrate management program to reduce further loading and prevent possible exposure. If nitrate concentrations continue to increase at all depths, more extensive action may be required. The District may need to investigate alternate water supplies for the many private well water users in the area. Alternate water supplies could include a water treatment plant to remove the nitrate from the existing groundwater supply or the treatment of water from the San Felipe pipeline.

More research is needed to determine how much nitrate is contributed through the various manure management practices currently used. Best Management Practices (BMPs) for manure management need to be determined, and they need to be communicated to the public in a manner that will encourage adoption. More research is also needed regarding reduction of nitrate loading from septic systems; specifically, regarding whether the benefit of removing or reducing septic system loading justifies the economic and political cost of increasing sewer line connections.

To achieve the objective of monitoring nitrate occurrence, the District will continue to sample the existing monitoring network in the Llagas and Coyote Subbasins on a quarterly basis. Two years of quarterly data has been collected so far and staff are in the process of analyzing the data for seasonal, areal, and long-term trends. Staff is beginning a thorough evaluation of the extent and severity of nitrate contamination in the Santa Clara Subbasin, based on water quality data from the District's groundwater monitoring program and the water retailers.

The District may also investigate the feasibility of remediating nitrate contamination. There is some indication that nitrate concentrations around recharge facilities are lower than elsewhere. This finding would need to be confirmed as part of an investigation into reducing nitrate concentrations by additional recharge. Similarly, the District may be able to remediate nitrate contamination by setting up several pump and treat operations. High nitrate water would be pumped out of the basin, treated and injected back into the basin. Phytoremediation, which uses deep-rooted plants to draw the nitrate out of the vadose zone before it can reach groundwater, may be employed in some areas. A fourth possibility is reactive zone remediation where a reagent is injected into the system to intercept and immobilize or degrade the nitrate into a harmless end product. A thorough investigation of any remediation technology would need to occur before prior to its adoption.

SALTWATER INTRUSION PREVENTION

Program Objective
The objective of the Saltwater Intrusion Prevention Program is to monitor and to protect the groundwater basin from seawater intrusion.

Background

The movement of saline water into a freshwater aquifer constitutes saltwater intrusion. This potential exists in groundwater basins adjacent to the sea or other bodies of saline water. Intrusion of saltwater into a freshwater aquifer degrades the water for most beneficial uses and, when severe, can render it virtually unusable. Salty water can corrode holes in well casings and travel vertically to other aquifers not previously impacted. Once freshwater aquifers are rendered useless by a severe case of saltwater contamination or intrusion, it is extremely difficult and costly to reclaim them.

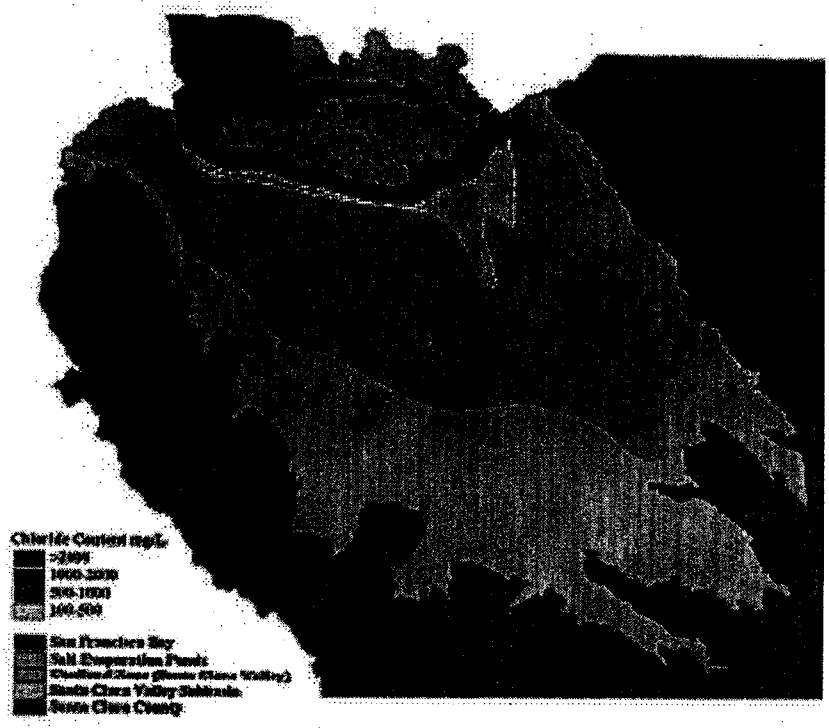
Comparison of older mineral analyses of groundwater from wells in the San Francisco bayfront area in Santa Clara and Alameda counties, some dating back to 1907, with more recent data shows that saltwater intrusion has occurred in the upper aquifer. With much higher water demands after World War II and the occurrence of land subsidence, saltwater intrusion conditions became aggravated and encompassed a portion of the baylands (the area adjacent to the southern San Francisco Bay). Bayshore Freeway (U.S. Route 101) and the Nimitz Freeway (Interstate 880) delineate the southern limits of this area.

The alluvial fill deposits of the Santa Clara Valley Subbasin in the flat baylands area consist of thin aquifers amongst abundant clays. The aquifers are broadly grouped into two water-bearing zones referred to as the "upper aquifer zone," which usually occurs at depths less than 100 feet, and the "lower aquifer zone," which usually occurs at depths greater than 150 to 250 feet, and which constitutes the potable aquifer system. Previous studies indicate the upper aquifer zone fringing San Francisco Bay is widely intruded by saltwater. The lower aquifer zone has pockets of small areas of elevated salinity associated with migration through abandoned wells.

Within the upper aquifer zone, the "classical case" of intrusion which occurs by displacement of freshwater by seawater and is indicated by total dissolved salt content over 5,000 mg/L, has progressed only a short distance inland from the bayfront, estuaries or salt evaporator ponds as shown in Figure 5-3. This intrusion had been induced when pumping of the upper aquifer and land subsidence reversed the hydraulic gradients, which had originally been toward the Bay. A large mixed transition zone precedes this intruding front with its outer limit arbitrarily defined by the 100 mg/L chloride line.

The greatest inland intrusion of the mixed transition water occurs along Guadalupe River and Coyote Creek. The large mixed transition zone is caused by saltwater moving upstream during the high tides and leaking through the clay cap into the upper aquifer zone when this zone is pumped. Land surface subsidence has aggravated the condition of intrusion by allowing farther inland incursion of saltwater up the stream channels from the Bay and by changing the gradient directions.

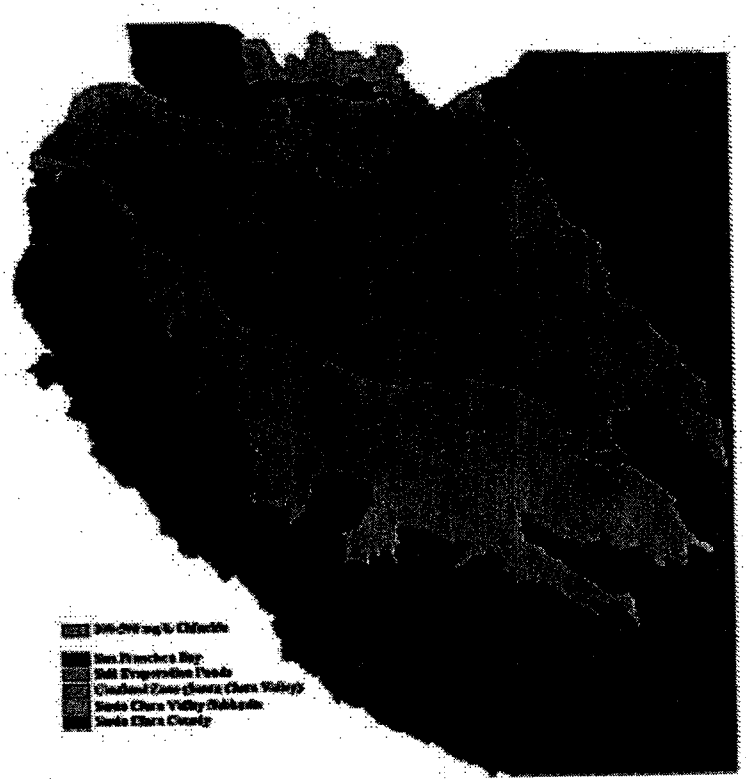
Figure 5-3
Upper Zone Saltwater Intrusion



Data has revealed a local area of high salt concentration in the upper aquifer zone in the Palo Alto bayfront area. This locally concentrated groundwater has moved inland historically and has the potential to continue farther inland. It is in this area that the District constructed a 2-mile-long hydraulic barrier in order to prevent further intrusion and to reclaim portions of the intruded aquifers.

The lower aquifer zone is only mildly affected; the area of elevated salinity encompasses a much smaller area than that of the upper aquifer zone (Figure 5-4). The contaminated lower aquifers lie beneath the intruded portion of the upper aquifer zone. The areal distribution and the variable concentration of the saltwater contamination with time imply that the intrusion into the lower aquifer occurred as seasonal slugs of contaminated water were induced from either the surface or the upper aquifer. As the clay aquitard between the upper and lower aquifer zones is essentially impermeable, the salinity in the lower aquifer zone is thought to have occurred through improperly constructed, maintained or abandoned wells. As a result of this finding, the operation of the hydraulic barrier was discontinued.

Figure 5-4
Lower Zone Saltwater Intrusion



The resumption of land surface subsidence is the greatest potential threat to aggravating the intrusion condition, as it would further depress the land surface fronting South San Francisco Bay. This would increase the inland hydraulic gradient relative to the classical intrusion front and expose a larger area of the upper aquifer zone to intrusion as a consequence of the greater inland incursion of tidal waters. A lowering of the piezometric level in the lower aquifers, which is related to the cause of subsidence, will also increase the potential for intrusion into the lower zone.

Current Status

As part of the Saltwater Intrusion Prevention Program, the defective wells in the northern Santa Clara Valley Subbasin along San Francisco Bay were to be located and destroyed. The District conducted an extensive program of locating and properly destroying these contaminant conduit wells. After these defective wells were located, the owners were required to properly destroy them under District ordinance, or by litigation if necessary. From District records, a list of 45 defective wells to be destroyed was generated.

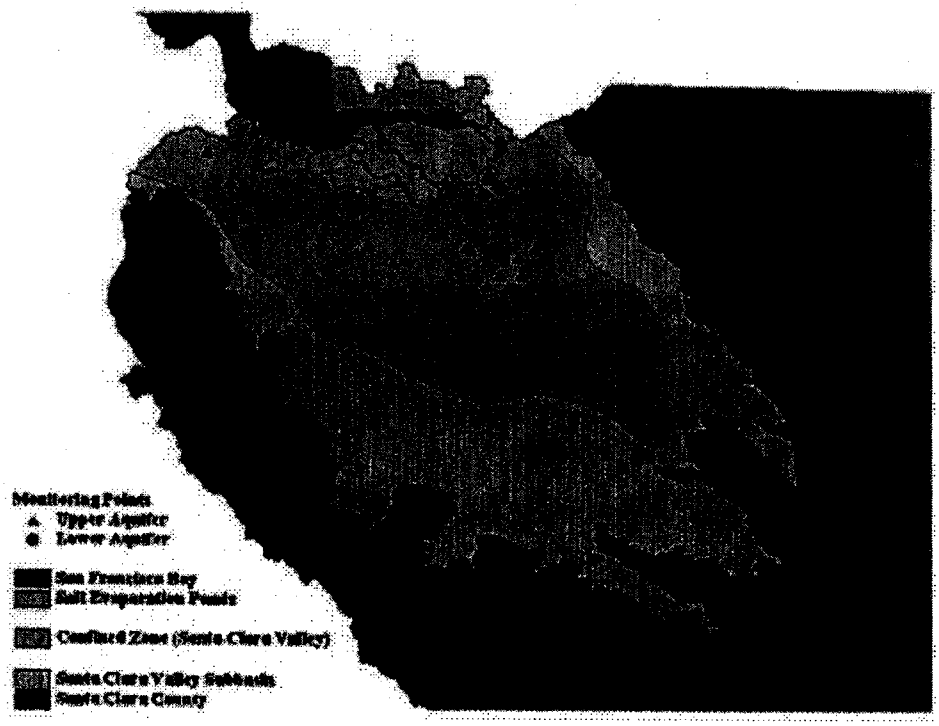
Since the inception of this program, the Board has authorized a more comprehensive well destruction program, through which abandoned wells near areas of known chemical contamination can be destroyed with District funds. This program began in October 1984, and was in part a result of general concerns about contamination of useable aquifers by saltwater as well as by industrial chemicals throughout the County. Several

wells in the area were included in this parallel program, many of which were not identified as defective or potential conduit wells.

Of the 45 potential conduit wells, six were removed from the list as they do not appear to be acting as conduits. In 1985, the District's Groundwater Protection Section pursued destroying the remaining 39 wells through District Ordinance No. 85-1. This ordinance gives the District authority to require owners of wells determined to be "public nuisances" to destroy the wells or to upgrade them to active or inactive status. Of the 39 potential conduit wells identified, 10 were not located and were presumed destroyed without a permit. The remaining wells were all properly destroyed.

The District continues to monitor the extent and severity of saltwater intrusion. The current Saltwater Intrusion Monitoring Program consists of 21 monitoring wells that are sampled quarterly as shown in Figure 5-5. Five of these wells monitor the status of saltwater intrusion in the lower aquifer zone, while the remaining 16 wells monitor the upper aquifer zone. Originally, the program consisted of 25 wells. Eight of these wells could not be located during recent field investigations and presumably were destroyed by the owners. However, work is commencing to replace the lost wells with District-owned wells and restore the monitoring program to its original form.

Figure 5-5
Saltwater Intrusion Monitoring Locations



Future Direction

The present status of the Saltwater Intrusion Prevention Program is subject to change, depending upon the future basin operation and groundwater demand in the area. The two economically practical ways to prevent or minimize any further intrusion are through management of the groundwater basin and strict enforcement of ordinances on well construction and destruction standards. These approaches have been adopted by the District and should continue to be implemented.

Saltwater intrusion continues to be monitored. Monitoring data are stored by electronic and conventional means. Electronic storage consists of a geographically referenced database of monitoring wells and a related database of water quality information. Conventional storage consists of filing hard copies of laboratory analytical reports in the appropriate well folders and providing data to DWR. Biennial evaluations of the data are documented in the General Groundwater Quality Monitoring Program reports. The monitoring program, including well location and sampling frequency, will be evaluated with respect to long-term groundwater quality protection strategies and overall basin management.

WELL CONSTRUCTION/DESTRUCTION PROGRAMS

Well Ordinance

Program Objective

The objective of the Well Ordinance Program is to protect the County's groundwater resources by ensuring that wells and other deep excavations are constructed, maintained and destroyed such that they will not cause groundwater contamination. To meet this goal, the Well Ordinance Program:

- Develops standards for the proper construction, maintenance, and destruction of wells and other deep excavations.
- Educates the public, including contractors, consultants and other government agencies about the Well Ordinance and the Well Standards.
- Verifies that wells are properly constructed, maintained and destroyed using a permitting and inspection mechanism.
- Takes enforcement action against violators of the well ordinance.
- Maintains a database and well mapping system to document information about well construction and destruction details, a well's location, and well permit and well violation status.

The scope of the Well Ordinance Program includes all activities relating to the construction, modification, maintenance, or destruction of wells and other deep excavations in the County.

Background

In the late 1960s, following post-war industrialization and development of Santa Clara County, it became apparent that abandoned or improperly constructed wells and other deep excavations (e.g. elevator shaft pits) are potential conduits through which contaminants can travel from shallow, potentially contaminated aquifers, to deeper drinking water aquifers. Recognizing this, in 1971, a District advisory committee consisting of representatives from local agencies, the District, and the Association of Drilling Contractors, was established.

The committee was charged with the development of well construction standards and standards for the proper destruction of abandoned wells. The Board adopted standards for well destruction and construction in October 1972 and January 1975, respectively. In 1975, the District Board of Directors passed the first District Well Ordinance.

Both the Standards and the Well Ordinance have undergone numerous revisions. The most recent version of the well standards, the *Standards for the Construction and Destruction of Wells and Other Deep Excavations in Santa Clara County*, was adopted by the Board in July 1989. The Board passed district Well Ordinance 90-1 in April 1990. These documents address the permitting and proper construction and destruction of wells and other deep excavations, including water supply wells, monitoring wells, remedial extraction wells, vadose wells, cathodic protection wells, injection wells, storm water infiltration wells and elevator shaft pits.

Beginning in 1975, well construction and destruction permits were required by the District and the District began inspecting every well that was constructed. Well destruction activities were first inspected by the District in 1984.

Since the inception of well permitting, the annual number of permits issued has greatly increased. The District issued approximately 400 well permits in 1976, the first full year of permitting, to a maximum of approximately 2,544 permits in 1994.

The District is in compliance with Sections 13803 and 13804 of the State Water Code and thereby has the authority to assume the lead role in the enforcement of the State Well Standards, the assignment of State Well Numbers, and the collection of State Drillers Reports for all wells constructed or destroyed in Santa Clara County.

Current Status

To date, the District has permitted and inspected the construction of approximately 3,000 water supply wells, 22,000 monitoring wells, 4,000 exploratory borings, and the destruction of 9,500 wells under the Well Ordinance Program.

The District has recently completed converting the paper-based well maps to a GIS based well mapping system.

Future Direction
In order to continue protecting the District's groundwater resource, the District will continue implementation of the program and will continue to regulate the construction and destruction of wells in the County. District staff will re-write District's well standards and ordinance to address recent changes in well construction and destruction techniques. District staff is also currently evaluating District's existing well information database and would like to convert the database into a relational database format and link it to the newly developed GIS based Well Mapping System.

Dry Well Program

Program Objective
The objective of the Dry Well Program is to minimize the impacts of dry wells on groundwater quality. The main objectives of this program are to:

- Control installation of new dry wells.
- Destroy existing dry wells that have contaminated or may contaminate groundwater.
- Educate planning agencies and the public about the threat that dry wells pose to groundwater quality.

Background
Dry wells, also known as storm water infiltration devices, are designed to direct storm water runoff into the ground. Storm water runoff can carry pollution from surface activities. Because dry wells introduce runoff directly into the ground, they circumvent the natural processes of pollution breakdown and thereby increase the chance of groundwater contamination. Additionally, dry wells have been sites of illegal dumping of pollutants.

In Santa Clara County, at least 8 serious contamination sites were caused or aggravated by the presence of dry wells introducing contamination into the groundwater. One dry well site has a solvent plume more than 2,000 feet long and more than 200 feet deep in a recharge area of South County where the only source of drinking water is groundwater.

In 1974, the Environmental Protection Agency (EPA) developed the Underground Injection Control Program under the Safe Drinking Water Act. The program requires the owners and operators of all shallow drainage wells to submit information regarding the status of each well to the EPA. The Regional Board adopted the "Shallow Drainage Wells" amendment to the Basin Plan in 1992. The Basin Plan amendment requires the local agency to develop a shallow drainage well control program that would locate existing shallow wells and establish a permitting program for existing and new wells.

In 1991, the District and municipal agencies began development of a Storm Water Infiltration Policy to satisfy Regional Board requirements. In August 1993, the District adopted Resolution 93-59 regarding Storm Water Infiltration Devices.

Current Status

Since 1993, owners of dry wells deeper than 10 feet have been required to register their wells by filing a "Notice to Continue Use" with the District. Dry well owners can continue using their wells as long as the well is not an immediate threat to groundwater quality. Local cities, businesses, contractors and private citizens regularly call for District guidance on dry wells.

The District continues to issue permits for dry wells greater than 10 feet deep and for the destruction of dry wells. District staff advise the public and planning agencies about the appropriate use of dry wells to mediate storm water problems generally and on a case-by-case basis. District staff continue to work with local programs to clarify the District dry well policy. Local inspecting agencies continue to work with the District to locate and register dry wells.

Future Direction

The Dry Well Program is being incorporated into the Well Ordinance Program. Specific standards for dry wells will be incorporated into the next revision to the Well Standards. These standards include prohibiting the construction of dry wells greater than 10 feet deep and defining dry wells to include all shallow drainage wells, not just shallow drainage wells receiving storm water. The purpose of revising the program to incorporate it into the Well Ordinance Program is to clarify permitting and construction standards for dry wells, to expand the definition of devices covered by the Well Standards so that all wells that bypass natural protection processes are subject to standards for protecting groundwater, and to simplify the process by which dry wells are permitted.

Abandoned Water Well Destruction Assistance

Program Objective

The objective of the Abandoned Well Destruction Assistance Program is to protect the County's groundwater resources by helping property owners properly destroy old, abandoned water supply wells that they have discovered.

To meet the program's objective, the District:

- Passed a Board Resolution (94-87) allowing District assistance to property owners who discover abandoned wells.
- Enters into annual contracts with well drillers to complete work associated with the project.
- Destroys abandoned wells for property owners.

Background

Due to the agricultural history of the County and to subsequent post-World War II development, many former water supply wells were abandoned and buried and remain

potential vertical conduits that may transport contaminants into the District's deep, water supply aquifers.

Some estimates indicate that there may be as many as 10,000 abandoned water supply wells within the boundaries of the Santa Clara Subbasin. Since there are no official records for these wells, the District has no knowledge of their existence or their locations.

In the mid-1980s, the District took a proactive stance on active and abandoned water supply wells found within known contamination plumes. At that time, with assistance from the Regional Board, the District actively searched for and destroyed known active wells and abandoned wells.

However, when abandoned water wells were discovered in areas not threatened by known groundwater contamination, they were not included in the District's well destruction efforts, but instead were treated as well violations under the Well Ordinance Program. As well violations, the District proceeded with enforcement action to force the property owner to properly destroy the well.

Unfortunately, this enforcement action often took months to complete. Property owners often didn't have the $3,000 to $15,000 dollars needed to destroy the well and had to secure loans to complete the destruction. Many property owners had negative feelings about the District after the enforcement action, especially considering that most property owners had no previous knowledge of the well and when they had discovered the well, they had been the first to inform the District of its existence.

District staff believed that while a well was found on an owner's property (and according to the Well Ordinance, that the property owner is responsible for destroying it), the owner wasn't actually responsible for the well's current status (abandoned and buried) and because the destruction of the well was in the best interest of the District, that the District should destroy it.

Therefore, in 1994, the District initiated the Abandoned Well Destruction Assistance Program to aid property owners who happen to discover an abandoned water supply well on their property. Under the Abandoned Well Destruction Program, the District destroys abandoned water wells if: 1) the property owner had no previous knowledge of the well, 2) the well was not registered with the District, 3) the well has no surface features that would have obviously indicated its presence, and, 4) the property owner enters into a Right of Entry Agreement with the District.

Current Status

Since the program's inception in 1994, the District has destroyed 108 abandoned wells under the Abandoned Well Destruction Program. Most of these wells were first discovered and reported to the District because they were flowing under artesian pressure.

Future Direction
Staff will continue to implement the program. Annually, staff receives reports of approximately 20 wells that meet program criteria and staff expect that this trend to continue.

WELLHEAD PROTECTION

Program Objective
The Wellhead Protection Program (WHP) represents the groundwater portion of the District's Source Water Assessment Program. The objective of the Wellhead Protection Program is to identify areas of the groundwater basin that are particularly vulnerable to contamination. The District uses this knowledge to focus groundwater protection, monitoring, and cleanup efforts.

Background
Groundwater vulnerability is based on groundwater sensitivity to contamination and the presence of potentially contaminating activities. Groundwater sensitivity is evaluated based on hydrogeology and groundwater use patterns. Areas with shallow groundwater, high recharge, high conductivity aquifers, permeable soils and subsurface materials, mild slopes, and high groundwater pumping rates are most sensitive to contamination. The District compiles data on hydrogeologic conditions, pumping patterns, and contamination sources, and uses GIS technology to identify areas of the groundwater basin that are particularly vulnerable to contamination.

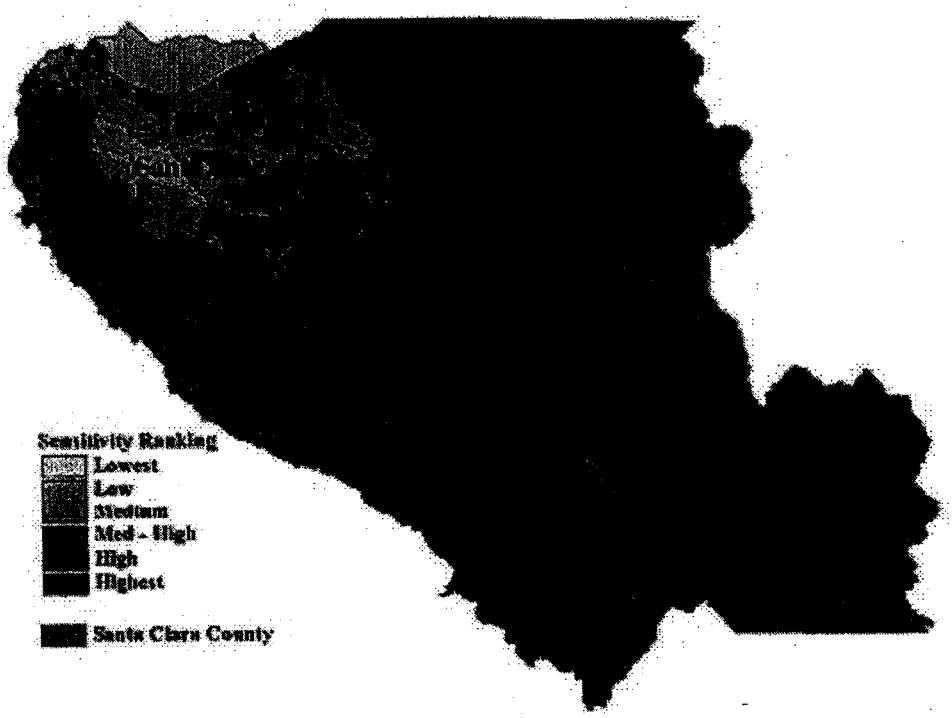
The District first began compiling groundwater protection data in the late 1980's. In 1989, the District, in collaboration with the U.S. Environmental Protection Agency (EPA), conducted a pilot project in the Campbell area to evaluate the usefulness of GIS for groundwater protection. Data on roads, city boundaries, hazardous material storage sites, groundwater recharge facilities, wells and hydrogeology were collected and used to create GIS coverages for the Campbell study area. The project team used GIS to evaluate groundwater sensitivity and draw areas to be protected around production wells. The study concluded that GIS is a feasible tool to use for WHP programs.

After the Campbell pilot study, the District expanded its groundwater protection data collection effort to encompass the entire County. Staff developed Countywide GIS coverages of active wells, abandoned and destroyed wells, geology, soil types, depth to groundwater, leaking underground storage tank sites, and petroleum storage facilities. This data, along with water quality data, is used to identify and evaluate threats to groundwater quality.

Current Status
The District created a groundwater sensitivity map to evaluate land use development proposals and make recommendations for appropriate groundwater protection strategies. In 1996, the District built upon the pilot GIS project to assess groundwater sensitivity throughout the groundwater basin using EPA's DRASTIC method. DRASTIC stands for

depth to water table, net recharge, aquifer media, soil media, topography, impact of the vadose zone, and hydraulic conductivity of the aquifer. The DRASTIC method is a quantitative evaluation of these hydrogeologic factors to assess relative groundwater sensitivity. The results of this effort were several GIS coverages and a groundwater sensitivity map (Figure 5-6), which the District uses to review land development proposals. In sensitive groundwater areas, the District requests that planning agencies require, and that property owners implement, best management practices and other protection activities beyond those required by minimum standards.

Figure 5-6
Groundwater Sensitivity Map



Staff uses information on land use and the location of contaminated sites to help identify and evaluate the sources of contamination that are detected in wells. Although groundwater quality is generally good throughout the basin, contamination is occasionally detected in individual wells. By quickly locating contamination sources, we can work with the regulatory agencies to ensure prompt and adequate cleanup.

The District also uses information on well construction, well location, well pumping, leaking Underground Storage Tank (UST) site locations and conditions, land use, and hydrogeology to prioritize leaking UST sites and identify vulnerable water supply wells. Sites that pose the greatest threat to groundwater supplies are the first to receive detailed regulatory oversight. Staff also uses this information to select wells for groundwater monitoring and special studies.

District staff is working with local water retailers on the state's Drinking Water Source Assessment and Protection (DWSAP) Program. The state's DWSAP Program is required by the 1996 reauthorization of the federal Safe Drinking Water Act. California has until May 2003 to assess all of its drinking water sources for vulnerability to contamination. The District developed a GIS-based wellhead assessment and protection area delineation tool, which delineates protection areas according to state guidelines. Once the vulnerability assessments are completed in Santa Clara County, the District will work with the water retailers to ensure that the greatest threats to their drinking water supply wells are being addressed.

Future Direction
District staff continues to create GIS coverages that help assess groundwater vulnerability. Some coverages that are in development include solvent contamination sites and plumes, dry cleaners, hazardous materials storage facilities, septic system locations, and sewer lines. The District has found great utility in these GIS coverages, and is beginning to work with other agencies and organizations to determine how we can share GIS information and increase its use for groundwater protection. We will continue to use this information to identify areas vulnerable to groundwater contamination, and focus our monitoring, protection, and cleanup efforts.

LEAKING UNDERGROUND STORAGE TANK OVERSIGHT

Program Objective
The objective of the Leaking Underground Storage Tank Oversight Program (LUSTOP) is to protect the groundwater basin from water quality degradation as a result of releases of contaminants from underground storage tanks. The District provides regulatory oversight of the investigation and cleanup of fuel releases from USTs for most of Santa Clara County.

Background
In 1983, the State Legislature enacted the UST Law [Chapter 6.7 of the Health and Safety Code] authorizing local agencies to regulate the design, construction, monitoring, repair, leak reporting and response, and closure of USTs. In the early 1980s, several drinking water wells in the County were shut down as a result of contamination by chlorinated solvents. In 1986, the Board decided to implement a leaking UST oversight program for petroleum fuels in coordination with the San Francisco Bay Regional Water Quality Control Board (RWQCB). The District Board recognized that releases from USTs affect groundwater quality and that effective protection of the County's groundwater basin demanded a proactive approach. They committed financial and technical resources in-house to quickly initiate the program.

In 1987, the District entered into an informal agreement with the San Francisco RWQCB to create a pilot oversight program. At that time more than 1,000 fuel leaks had been reported within the County. The District developed an in-house technical group of employees capable of providing regulatory oversight of the investigation and cleanup of

releases from USTs. In 1988, the District and the County of Santa Clara entered into a contract with the State Water Resources Control Board to implement one of the State's first Local Oversight Programs. This allowed the District to get reimbursed by state and federal funds for costs associated with operation of the program.

The State Water Resources Control Board (SWRCB) amends its Local Oversight Program contract with the District and the County annually. Over the years, many changes have occurred in the UST regulatory process as new laws were passed, scientific knowledge improved, and new investigation and cleanup strategies became available. The District's program actively participates in ensuring that new laws and regulations continue to protect groundwater quality into the future. The District has been at the forefront of several initiatives for improving the effectiveness and efficiency of our regulatory oversight efforts and the cost-effectiveness of corrective action while protecting human health, safety, the environment and water resources.

Every leaking petroleum UST case is currently assigned to a District caseworker who provides technical and regulatory guidance to responsible parties and their consultants (Figure 5-7).

Figure 5-7
Fuel Leak Cases in Santa Clara County

The District only provides regulatory oversight on investigation and cleanup at UST sites where a release has occurred. Tank removals, leak prevention, and UST release detection activities are overseen by one of 10 other agencies, usually the local fire department. Each agency has jurisdiction over a designated geographical area in the County. If there is evidence of a leak or if contamination is detected, an agency inspector or UST owner/operator notifies the District and/or the Regional Board. The District reviews the data to confirm the release, lists the site on the Leaking Underground Storage Tank Oversight Program database, and notifies the responsible party and the SWRCB. The District then determines if the unauthorized release poses a threat to human health and safety, the environment, or water resources and, if necessary, a caseworker requests additional investigation and cleanup.

To get case closure for the release, the responsible party must provide evidence that the release does not pose a significant threat to human health and safety, the environment or water resources; or, that the release has been adequately investigated and cleaned up. Fuel leak investigation and cleanup is closely monitored by a caseworker, and the case is promptly closed when the unauthorized release no longer poses a threat to human health, safety, the environment or water resources.

Current Status

As of January 2000, a total of 2,315 fuel leak cases have been reported in the County, the majority of which have affected groundwater. Approximately 1,650 (71 percent) of reported leak cases have been closed. About 575 cases are currently within the District's UST program, while about 75 cases receive Regional Board oversight. As a local oversight program, the District has made significant progress in closing low-risk sites and sites that have performed appropriate corrective action to reduce contamination to below levels of regulatory concern.

The presence of Methyl tert-Butyl Ether (MTBE) in gasoline has precipitated additional changes in the UST regulatory process and the manner in which sites are investigated and cleaned up. Since 1995, MTBE and other oxygenates have emerged as significant contaminants at fuel leak sites within the County, causing increased concern for the protection of groundwater resources. MTBE has been blended into gasoline in high percentages (up to 15 percent by volume) beginning in the winter of 1992 with the intent to significantly improve air quality. However, MTBE is a recalcitrant chemical in groundwater, as it does not undergo significant breakdown (bio-degradation) in groundwater. As a result, MTBE contamination can migrate considerable distances in groundwater and may impact wells miles downgradient. MTBE has been detected at more than 375 current fuel leak cases in the County, with concentrations at these sites ranging from 5 parts per billion to more than 1 million parts per billion. The District has taken a progressive and vigilant approach to protecting groundwater resources from MTBE contamination through the use of GIS to manage and analyze both UST site and regional information and in demanding a more intense and detailed level of work be performed at MTBE release sites.

The District is also very concerned regarding the increasing occurrence of MTBE at operating gasoline stations, which poses a significant threat to municipal drinking water wells within the County. In response to this threat, the District completed two studies of operating gasoline stations that were in compliance with the 1998 UST upgrade requirements. The first study, completed by Levine-Fricke in 1999, involved soil and groundwater sampling at 28 facilities to determine if releases were occurring from upgraded UST systems. MTBE was detected in groundwater at 13 of the 27 sites where groundwater was encountered. The second study, completed in 2000 (SCVWD, 2000), was a case study of 16 sites with operating USTs and high levels of MTBE in groundwater to evaluate whether undetected releases are occurring and to assess weaknesses in fuel storage, management, and delivery operation. Of the 16 sites studied, undetected releases were suspected at 13 sites.

Despite the fact that gasoline stations have been upgraded to meet stringent requirements, it is clear that faulty installations, poor maintenance and poor facility operation practices are resulting in leaks, and that improvements in the management of USTs are needed to prevent widespread contamination of groundwater.

Future Direction

The District continues to provide technical guidance and regulatory oversight to cases using improved scientific knowledge and latest investigation and cleanup strategies. The District will continue to work closely with local universities, research organizations, the water community, major oil companies, local, state and federal agencies, and the state and federal legislature to ensure that problems in the UST program are identified and that prompt effective solutions are implemented to protect groundwater quality.

An effective UST leak prevention and monitoring program is essential. There are several studies underway regarding the effectiveness of leak prevention and monitoring systems at sites. The District will continue to monitor all developments in this area and propose ongoing studies and/or regulatory changes. To ensure water resources are protected, the District actively participates in the legislative process to ensure that recalcitrant chemicals like MTBE that can cause significant groundwater degradation are not used in fuels.

One of the biggest concerns for the District regarding MTBE is the significance of both short-term and long-term threats to groundwater quality. The District is committing additional resources to gain a more extensive understanding of the groundwater basin, groundwater flow patterns, and groundwater pumping trends. This improved understanding allows for better decisions regarding: the level of oversight necessary at sites; how much investigation is required to properly understand the nature and extent of contamination at sites; the level of cleanup necessary to protect groundwater resources; and the effectiveness of the program in preventing significant short-term and long-term water quality degradation.

The District will continue responding to the public regarding USTs and groundwater contamination and will ensure that files and information are available for public review.

District staff plan to have all fuel leak files scanned and electronically accessible over the Internet in the near future. Program guidance, site information, and news of the latest developments in the program are available on the District's web site.

TOXICS CLEANUP

Program Objective

The objective of the Toxics Cleanup Program is to ensure the protection of the groundwater basins from water quality degradation as a result of toxics and solvent contamination and spills of other non-fuel chemicals. The District performs peer review of these cases and makes water use and geologic information available to the public and environmental consultants. District staff also provide expert technical assistance to the regulatory agencies (County of Santa Clara, San Francisco and Central Coast Regional Boards, Department of Toxics Substances Control, and the Federal Environmental Protection Agency) responsible for the oversight of investigation and cleanup at non-fuel contaminated sites within Santa Clara County.

Background

Since the late 1970s, the District has provided expert technical and hydrogeologic assistance to agencies having the legal responsibility for the protection of the water resources serving the needs of Santa Clara County. The discovery of groundwater contamination at Fairchild Semiconductor in 1981 resulted in heightening the awareness for the protection of groundwater quality and the need for the District to be actively involved in ensuring that appropriate investigation and cleanup of sites was undertaken in a timely manner. District staff were actively involved with the review and analysis of early laws governing the regulation of underground storage tanks and hazardous materials and in laws, regulations, and policies to ensure groundwater resource protection. District staff have documented the migration of contamination down abandoned wells and conduits and fashioned a well installation and destruction ordinance to ensure that wells were properly installed and potential conduits properly destroyed.

Current Status

The District has records of over 700 releases of non-fuel related cases involving the release of solvents, metals, pesticides, Polychlorinated Biphenyls (PCBs), and a variety of other chemicals in Santa Clara County. The San Francisco Bay RWQCB provides regulatory oversight on over 600 cases in the Santa Clara Valley and Coyote Subbasins. The Central Coast RWQCB provides oversight on an estimated 35 cases in the Llagas Subbasin. The California Department of Toxics Substances Control provides oversight of 17 cases and the Federal EPA provides oversight of 11 sites.

The District maintains an elaborate filing system for these cases that is heavily used by the environmental consultants and the public researching contaminated sites. District staff actively track and peer review the most serious of these cases (primarily the Superfund sites). Staff provide review and comment on Site Cleanup Requirements and Cleanup and Abatement Orders prepared by the Regional Boards and investigation and cleanup reports prepared for these sites. The District provides geologic and technical

expertise to responsible parties (site owners and operators) and their consultants and staff, and regularly participate in various committees and public meetings to ensure groundwater protection issues are properly addressed.

Future Direction
The District plans to continue these efforts in addition to conducting a review of all the recorded cases to ensure that all have been properly addressed by the various regulatory agencies. Many cases have remained "inactive" and may not have performed appropriate investigation and cleanup. The District plans to inform the regional boards and other agencies of these reviews and assist them to ensure appropriate work is performed. The District also plans to make more information available regarding geologic conditions and the status of solvent and toxics cases in GIS and over the Internet.

LAND USE AND DEVELOPMENT REVIEW

Program Objective
The objective of the Land Use and Development Review Program is to evaluate the land use and developments occurring within the County for adverse impacts to watercourses under District jurisdiction and to other District facilities, including the pollution of groundwater.

Background
Land development decisions made by the cities and the County influence a variety of issues related to water quality and quantity. The District reviews land development proposals, identifies any potential adverse impacts to District facilities and provides comments to the lead agency charged with making the final decision for the proposals. The District also reviews Draft Environmental Impact Reports (DEIRs) and/or EIRs and provides comments to the lead agency.

Current Status
The District reviews and comments on proposed land development, environmental documents and city and County General plans. Review of land development proposals includes a determination of direct and indirect impacts to District facilities. Indirect impacts could result from increased runoff and flooding due to new impervious surface or introduction of pollutants to a watercourse from construction activities or urban runoff. Direct impacts to watercourses under District jurisdiction are addressed through the District's permitting program as defined by Ordinance 83-2.

This ordinance allows the District to investigate whether a proposed project or activity will:

a. Impede, restrict, retard, pollute or change the direction of the flow of water.

b. Catch or collect debris carried by such water.

c. Be located where natural flow of the storm and flood waters will damage or carry any structure or any part thereof downstream.

d. Damage, weaken, erode, or reduce the effectiveness of the banks to withhold storm and flood waters.

e. Resist erosion and siltation and prevent entry of pollutants and contaminants into water supply.

f. Interfere with maintenance responsibility or with structures placed or erected for flood protection, water conservation, or distribution.

If a project appears likely to do any of the above, the District may deny or conditionally approve the permit application for the proposed project.

Future Direction

The California Environmental Quality Act (CEQA) provides the District an opportunity to comment in areas relevant to the issues listed above; however, cities need to make certain these issues are adequately addressed and treated. The use of Ordinance 83-2 and CEQA have generally not effected adequate attention to these issues.

In years past the District has relied on local agencies to place conditions on development projects and to include provisions that address District water supply and flood protection measures. The recent increase in development and land use coupled with more stringent environmental concerns and requirements imposed by other regulatory agencies has made it necessary for the District to shift to a more proactive approach and to undertake greater participation in development planning activities. District land use and development review staff plan to participate on interagency project teams, conduct general plan review and revision, and development of relevant policies (such as riparian corridor and building setback policies). The program will also seek revisions to Ordinance 83-2, and greater education of land development planning staff and officials.

Additional Groundwater Quality Management Activities

Groundwater Guardian Affiliate

The District was designated as Groundwater Guardian Affiliate for the year 2000. Groundwater Guardian is an annually earned designation for communities and affiliates that take voluntary, proactive steps toward groundwater protection. The district earned the designation in 2000 based on activities such as conducting irrigation, nutrient, and pesticides management seminars, sponsoring a mobile irrigation management laboratory, and creating a prototype zone of contribution delineation tool for delineating wellhead protection areas. The Groundwater Guardian Program is sponsored by The Groundwater Foundation, a private, international, not-for-profit education organization that educates and motivates people to care about and for groundwater. The District will continue to participate in the program by submitting annual work plans and reports documenting our groundwater protection efforts.

Comprehensive Reservoir Watershed Management

The District has initiated a Comprehensive Reservoir Watershed Management Project to protect the water quality and supply reliability of the District's reservoirs. The District seeks to balance watershed uses, such as the rights of private property owners and public recreational activities, with the protection and management of natural resources. The District recognizes that preserving beneficial watershed uses can benefit reservoir water quality, which in turn benefits drinking water quality delivered to the District treatment plants and recharged into the groundwater basins.

Watershed Management Initiative

The District is an active participant in the San Francisco Bay Regional Water Quality Control Board's Santa Clara Basin Watershed Management Initiative (WMI). The purpose of the WMI is to develop and implement a comprehensive watershed management program. The goals of the WMI include balancing the objectives of water supply management, habitat protection, flood management, and land use to protect and enhance water quality, including the quality of water used for groundwater recharge and water in the groundwater basins. The WMI will develop a watershed management plan that will set out agreed upon actions to meet stakeholder goals, including water quality protection and enhancement.

Non-Point Source Pollution Control

The District along with other agencies is the co-permittee for National Pollution Discharge Elimination System (NPDES) permit number CAS029718. The co-permittees formed the Santa Clara Valley Urban Runoff Management Program in 1990 to develop and implement efficient and uniform approaches to control non-point source pollution in storm water runoff that flows to the South San Francisco Bay, in compliance with NPDES permit responsibilities.

Chapter 6
SUMMARY

The many groundwater management programs and activities described in this document demonstrate that the District is proactive and effective in terms of ensuring that groundwater resources are sustained and protected. A summary of existing District groundwater programs is presented here, organized by report section.

Groundwater Supply Management
The objective of the District's groundwater supply management programs is to sustain groundwater resources by replenishing the groundwater basin, increasing basin supplies, and mitigating groundwater overdraft. This is currently achieved through:

- In-stream recharge, including controlled and uncontrolled recharge through District facilities.
- Off-stream recharge through District percolation ponds and abandoned gravel pits, including activities to reduce turbidity of incoming water.
- Periodic water balance to reconcile water imports, inflows, releases, and changes in surface water storage.
- Direct injection recharge facilities.
- Water use efficiency programs.
- Estimation of operational storage capacity.
- Subsidence and groundwater flow modeling to evaluate potential impacts to the groundwater basin.
- Public outreach and education for water use efficiency programs.

Groundwater Monitoring
The District's groundwater monitoring programs provide basic data to assist in the evaluation of groundwater conditions. Programs include:

- Groundwater quality monitoring, including sampling for general minerals, trace metals, and physical characteristics.
- Groundwater elevation monitoring, including depth-to-water measurements and the development of groundwater contour maps.
- Groundwater extraction monitoring, which tracks groundwater use throughout the County.

- Land subsidence monitoring, which measures existing subsidence.

Groundwater Quality Management
Existing programs designed to protect the groundwater from contamination and the threat of contamination include the following:

- Nitrate management program designed to delineate, track, and manage nitrate contamination by monitoring nitrate occurrence, and by reducing further loading and the public's exposure to nitrate.

- Saltwater intrusion prevention program to prevent freshwater aquifers from degradation through monitoring and the sealing of contaminant conduit wells.

- Well construction and destruction programs to protect groundwater resources by ensuring that wells will not allow the vertical transport of contaminants.

- Wellhead protection program to identify areas of the basin that are particularly vulnerable to contamination to focus groundwater protection, monitoring, and cleanup efforts.

- Leaking underground storage tank oversight program to protect the groundwater from water quality degradation and provide regulatory oversight of investigation and cleanup of fuel releases from underground tanks.

- Toxics cleanup program to protect the basin from contamination by non-fuel chemicals.

- Land use and development review to evaluate land use proposals in terms of potential adverse impacts to District facilities.

- Public outreach and education for groundwater quality management programs.

Recommendations
In 1999, the District Board of Directors established Ends Policies that direct the Chief Executive Officer/General Manager to achieve specific results or benefits. The following Ends Policies are related to groundwater:

E.1.1.2. The water supply is reliable to meet current demands.
E.1.1.3. The water supply is reliable to meet future demands as identified in the District's Integrated Water Resource Plan (IWRP) process.
E.1.1.4. There are a variety of water supply sources.
E.1.1.5. The groundwater basins are aggressively protected from contamination and the threat of contamination.
E.1.1.6. Water recycling is expanded consistent with the District's Integrated Water Resource Plan (IWRP) within Santa Clara County.
E.1.2.2.3. Groundwater supplies are sustained.

Two of the Ends Policies directly relate to the management of groundwater resources: 1.1.5 - The groundwater basins are aggressively protected from contamination and the threat of contamination, and 1.2.2.3 - Groundwater supplies are sustained. As the District is now formally guided by these policies, we need to ensure that program outcomes match these ends.

Although the District manages the basin effectively, there is room for improvement of the groundwater programs in terms of meeting the Ends Policies and in the coordination and integration of the programs. Specific areas where further analysis is recommended include:

1. **Coordination between the Groundwater Management Plan and the Integrated Water Resources Plan (IWRP)** – As the District's water supply planning document through 2040, the IWRP has identified the operation of the groundwater basin as a critical component to help the District respond to changing water supply and demand conditions. Planning and analysis efforts for future updates of the Groundwater Management Plan and the IWRP need to be integrated in order to provide a coordinated and comprehensive water supply plan for Santa Clara County.

2. **Integration of groundwater management programs and activities** – Individual groundwater management programs tend to be implemented almost independently of other programs. A more integrated approach to the management of these programs, and to the management of the basin overall needs to be developed. Integration of these programs and improved conjunctive use strategies will result in more effective basin management.

3. **Optimization of recharge operations** – As artificial recharge is critical to sustaining groundwater resources, an analysis of the most effective amount, location, and timing of recharge should be conducted.

4. **Improved understanding of the groundwater basin** – In general, the existing groundwater management programs seem to focus on managing the basin to meet demands and protecting the basin from contamination and the threat of contamination. However, improving the District's understanding of the complexity of the groundwater basin is critical to improved groundwater management. The more we know about the basin, the better we can analyze the impact of different groundwater scenarios and management alternatives.

5. **Effective coordination and communication with internal and external agencies** – Improved communication and coordination will lead to improved groundwater management programs. Increased sharing of ideas, knowledge, and technical expertise among people involved with groundwater at the District will result in increased knowledge, well-coordinated and efficient work, and well-informed analyses and conclusions. Improved coordination with external agencies, such as retailers and state and federal organizations, will result in improved knowledge of customer needs and increased awareness of District activities.

A detailed analysis of the areas above and of all groundwater programs as they relate to Ends Policies and the groundwater management goal is recommended.

The next update of the Groundwater Management Plan, scheduled for 2002, will address the issues above and the overall management of the basin by presenting a formal groundwater management strategy for achieving the groundwater management goal in a practical, cost-effective, and environmentally-sensitive manner. The update will evaluate each groundwater program's contribution and effectiveness in terms of the groundwater management goal and Ends Policies. Measurement criteria will be developed, and if there is no direct connection between the Ends Policies and a specific program, that program's contribution to other linked programs will be analyzed. The update will include recommendations for changes to existing programs or for the development of new programs, standards, or ordinances. The update will also develop an integrated approach for the management of groundwater programs, and for the management of the groundwater basin in general.

Groundwater is critical to the water supply needs of Santa Clara County. Therefore, it is of the utmost importance that the District continues the progress begun with this Groundwater Management Plan. Increased demands and the possibility of reduced imported water in the future make effective and efficient management of the groundwater basin essential. The Groundwater Management Plan and future updates will identify how the management of the groundwater basin can be improved, thereby ensuring that groundwater resources will continue to be sustained and protected.

REFERENCES

Association of Bay Area Governments, 1997, Projection 98, Forecasts for the San Francisco Bay Area to the Year 2020.

California Department of Water Resources, 1975, Evaluation of Ground Water Resources, South San Francisco Bay, Vol. III: Northern Santa Clara County Area, Bulletin 118-1.

California History Center – De Anza College, 1981, Water in the Santa Clara Valley: A History.

County of Santa Clara Planning Office, 1994, Santa Clara County General Plan Book A.

David Keith Todd Consulting Engineers, Inc., 1987, Groundwater Management in Santa Clara Valley.

EOA, Inc., Woodward Clyde, 1997, Urban Runoff Pollution Management Plan.

Levine-Fricke, 1999, Santa Clara Valley Water District Groundwater Vulnerability Pilot Study: Investigation of MTBE Occurrence Associated with Operating UST Systems.

SCVWD, 1994, Water Supply Overview Study.

SCVWD, 1997, Integrated Water Resources Plan, Final Report.

SCVWD, 1997, Santa Clara Valley Urban Runoff Management Plan.

SCVWD, 1998, Private Well Water Testing Program Report.

SCVWD, 1999, Operational Storage of Santa Clara Valley Groundwater Basin.

SCVWD, 2000, An Evaluation of MTBE Occurrence at Fuel Leak Sites with Operating Gasoline USTs.

SCVWD, 2001, Operational Storage Capacity of the Coyote and Llagas Groundwater Subbasins (Draft).

Tibbets and Keifer, 1921, Santa Clara Valley Water Conservation Project.

USGS, 1988, Land Subsidence in the Santa Clara Valley, California, as of 1982, Professional Paper 497-F.